EXHIBIT L

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Cisco Systems, Inc.
Petitioner

v.

Capella Photonics, Inc.
Patent Owner

Patent No. RE42,368
Filing Date: June 15, 2010
Reissue Date: May 17, 2011

Title: RECONFIGURABLE OPTICAL ADD-DROP MULTIPLEXERS WITH SERVO CONTROL AND DYNAMIC SPECTRAL POWER MANAGEMENT CAPABILITIES

Inter Partes Review No. 2014-01166

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Exhibit 1019: Giles et al., Reconfigurable 16-Channel WDM DROP Module Using Silicon MEMS Optical Switches, IEEE Photonics Technology Letters, Vol. 11, No. 1, (Jan. 1999) ("Giles 16-Channel WDM DROP Module")

Exhibit 1020: Andrew S. Dewa, and John W. Orcutt, *Development of a silicon 2-axis micro-mirror for optical cross-connect*, Technical Digest of the Solid State Sensor and Actuator Workshop, Hilton Head Island, SC, June 4-8, 2000) at pp. 93-96 ("Dewa")

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Exhibit 1031: U.S. Patent No. 5,414,540 to Patel et al. ("Patel")

Exhibit 1032: Borella, et al., Optical Components for WDM Lightwave Networks, Proceedings of the IEEE, Vol. 85, NO. 8, August 1997 ("Borella")

Exhibit 1033: U.S. Patent No. 6,928,244 to Goldstein et al. ("Goldstein '244")

Exhibit 1034: Steffen Kurth et al., Silicon mirrors and Micromirror Arrays for Spatial Laser Beam Modulation, Sensors and Actuators, A 66, July 1998

Exhibit 1035: C. Randy Giles and Magaly Spector, *The Wavelength Add/Drop Multiplexer for Lightwave Communication Networks*, Bell Labs Technical Journal, (Jan.-Mar. 1999) ("Giles and Spector")

Exhibit 1036: U.S. Patent No. 5,872,880 to Maynard (the "Maynard patent")

Exhibit 1037: R.E. Wagner and W.J. Tomlinson, *Coupling Efficiency of Optics in Single-Mode Fiber Components*, Applied Optics, Vol. 21, No. 15, pp. 2671-2688 (August 1982)

Exhibit 1038: Excerpts from Born et al., PRINCIPLES OF OPTICS, (6th Ed., Pergammon Press 1984)

I. INTRODUCTION

Petitioner Cisco Systems, Inc. requests *inter partes* review under 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42, of claims 1-6, 9-13, and 15-22 (the "Petitioned Claims") of U.S. Patent No. RE42,368 (Ex. 1001) ("the '368 patent"), assigned on its face to Capella Photonics, Inc.

In prosecuting its reissue patent, Patentee admitted that its original claim set was overbroad and invalid in light of U.S. Patent No. 6,498,872 (Ex. 1003) ("Bouevitch"). To fix this claim drafting mistake and to distinguish over Ex. 1003, Patentee made two amendments to all of its independent claims. But those amendments merely swapped one known component for another known component. As described in the body of this petition, those amendments swapped one known type of mirror for another known type of mirror.

While the Patentee's reissue amendments may have addressed the novelty issues in light of Ex. 1003, those amendments do not overcome obviousness. Bouevitch in combination with the prior art described in the body of this petition renders the Petitioned Claims invalid as obvious.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)

A. Real Party-In-Interest under 37 C.F.R. § 42.8(b)(1)

Petitioner Cisco Systems, Inc. is the real party-in-interest for this petition.

B. Related Matters under 37 C.F.R. § 42.8(b)(2)

The ’368 Patent is asserted against Cisco in an on-going patent lawsuit brought by Patent Owner in *Capella Photonics, Inc. v. Cisco Systems, Inc.*, Civil Action Nos. 1-14-cv-20529 (“Capella litigation”), filed in the Southern District of Florida on February 14, 2014. Claims 1-6, 9-13 and 15-22 of the ’368 patent are asserted in the Capella litigation.

C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3)

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D. Service Information

As identified in the attached Certificate of Service, a copy of the present petition, in its entirety, including all Exhibits and a power of attorney, is being served by USPS EXPRESS MAIL, costs prepaid, to the address of the attorney or agent of record for the ’368 patent: Barry Young, Law Offices of Barry N. Young, P.O. Box 61197, Palo Alto, CA 94306. Petitioner may be served at the lead counsel address provided in Section I.C. of this Petition. Petitioner consents to service by e-mail at the e-mail addresses provided above.

E. Power of Attorney

A power of attorney is being filed concurrently with this petition in

accordance with 37 C.F.R, § 42.10(b).

III. PAYMENT OF FEES - 37 C.F.R. § 42.103

This petition for *inter partes* review requests review of 19 claims of the ’368 patent and is accompanied by a request fee payment of $24,600. *See* 37 C.F.R. § 42.15. Thus, this petition meets the fee requirements under 35 U.S.C. § 312(a)(1).

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.104

A. Grounds for Standing under 37 C.F.R. § 42.104(a)

Petitioner certifies that the ’368 patent is eligible for *inter partes* review and further certifies that Petitioner is not barred or otherwise estopped from requesting *inter partes* review challenging the identified claims on the grounds identified within the present petition.

B. Identification of Challenge under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested

Petitioner requests *inter partes* review of claims 1-6, 9-13, and 15-22 of the ’368 patent under the statutory grounds set forth in the table below. Petitioner asks that each of the claims be found unpatentable. An explanation of how the Petitioned Claims are unpatentable is included in Part VIII of this petition. Additional explanation and support for each ground of rejection is set forth in the Declaration of a technical expert, Dr. Dan Marom (Ex. 1028) (“Marom Decl.,”).

Ground	’368 Patent Claims	Basis for Challenge

Ground	'368 Patent Claims	Basis for Challenge
1	1-6, 9-13, and 15-22	Obvious under § 103(a) by Bouevitch in view of Smith.
2	1-6, 9-13, and 15-22	Obvious under § 103(a) by Bouevitch in view of Smith further in view of Lin.
3	12	Obvious under § 103(a) by Bouevitch in view of Smith in further view of Dueck.
4	12	Obvious under § 103(a) by Bouevitch in view of Smith and Lin in further view of Dueck.

Each of the references relied upon in the grounds set forth above qualify as prior art under 35 U.S.C., § 102(e) or (b).

This Petition and the Declaration of Dan Marom, submitted herewith, cite additional prior art materials to provide background of the relevant technology and to explain why one of skill in the art would combine the cited references.

C. Threshold Requirement for *Inter Partes* Review 37 C.F.R. § 42.108(c)

Inter partes review of claims 1-6, 9-13, and 15-22 should be instituted because this Petition establishes a reasonable likelihood that Petitioner will prevail with respect to at least one of the claims challenged. *See* 35 U.S.C. § 314(a). Each limitation of each challenged claim is disclosed by and/or obvious in light of the prior art.

V. BACKGROUND OF TECHNOLOGY RELATED TO THE '368 PATENT

Fiber-optic communication uses light to carry information over optical fibers. Originally, fiber-optic systems used one data channel per fiber. To increase the number of channels carried by a single fiber, wavelength division multiplexing ("WDM") was developed. WDM is a type of optical communication that uses different wavelengths of light to carry different channels of data. WDM combines (multiplexes) multiple individual channels onto a single fiber of an optical network. WDM was known before the '368's priority date. (E.g., Ex. 1015 at 904.)

At different points in a fiber network, some of the individual channels may be extracted (dropped) from the fiber, for example when those channels are directed locally and need not be passed further down the fiber network. And at these network points, other channels may also be added into the fiber for transmission onward to other portions of the network. To handle this add/drop process, optical add-drop multiplexers (OADMs) were developed. OADMs are used to insert channels onto, pass along, and drop channels from an optical fiber without disrupting the overall traffic flow on the fiber. (Ex. 1001 at 1:51-58.) OADMs were known long before the '368 priority date. (E.g., Ex. 1015 at 904.)

(Re)configurable OADMs are referred to as "ROADMs" or "COADMs," which are controllable to dynamically select which wavelengths to add, drop, or

pass through. (Ex. 1003 at Abstract; Ex. 1019 at 64.) These types of devices were known in the art prior to the '368 priority date. (Marom Decl., Ex. 1028 at ¶ 29.)

ROADMs operate by separating the input light beam into individual beams—each beam corresponding to an individual channel. Each input channel/beam is individually routed by a beam-steering system to a chosen output port of the ROADM. For example, a first channel can be steered so that it is switched from an "input" port to an "output" port. Channels switched to the "output" port are passed along the network. At the same time, a second channel can be switched to a "drop" port and removed from the main fiber. The ROADM could also add a new channel to the main fiber through the "add" port to replace the dropped channel. These add/drop techniques were known prior to the '368 priority date. (Ex. 1028 at ¶ 29; Ex. 1003 at 5:15-38; Ex. 1016 at 1:55-2:45; Ex. 1017 at 1:56-67.)

In addition to routing channels, ROADMS may also be used to control the power of the individual channels. Power control is often performed by steering individual beams slightly away from the target port such that the misalignment reduces the amount of the channel's power that enters the port. This misalignment power control technique in ROADMs was known prior to the '368 priority date. (*See e.g.*, Ex. 1028 ¶ 35, ¶ 60; Ex. 1006 at 2:9-21.)

ROADMs use wavelength selective routers (WSRs) to perform switching

and power control. (*See, e.g.*, Ex. 1026 at 10:64-11:29.) WSRs are also referred to as wavelength selective switches (WSSs). (*See*, *e.g.*, Ex. 1027 at Fig. 1.) As of the '368 priority date, WSRs/WSSs were known. (*See, e.g.,* Ex. 1026 at Abstract, 4:15-25; Ex. 1027 at Fig. 1; Ex. 1032 at 1292, 1300.)

The embodiment of WSRs relevant to this petition steers light beams using small tilting mirrors, sometimes called MEMS, which stand for Micro ElectroMechanical Systems. (Ex. 1028 ¶ 36, 31.) Prior-art WSRs could tilt the individual mirrors using analog voltage control. (*Id.*) The tilt allows reflected beams to be aimed at selected ports. Prior-art MEMS mirrors could be tilted in one or two axes. (*Id.* at 37.)

VI. SUMMARY OF THE '368 PATENT

The '368 patent originally issued as U.S. Patent No. 6,879,750. According to the Patentee, the original patent's claims were invalid over Bouevitch. The Patentee expressly acknowledged its claiming mistake and identified the two elements that it alleged needed to be added to its claims to support patentability– (1) mirror control in two-dimensions, and (2) the mirror's use for power control:

> ***At least one error upon which reissue is based is*** **described as follows:** ***Claim 1 is deemed to be too broad and invalid in view of U.S. Patent No. 6,498,872 to Bouevitch*** and further in view of one or more of Ex. 1023 U.S. Patent No. 6,567,574 to Ma, Ex. 1024 U.S. Patent No. 6,256,430 to Jin, or Ex. 1025 U.S. Patent No. 6,631,222 to Wagener ***by***

> ***failing to include limitations regarding the spatial array of beam deflecting elements being individually and continuously controllable in two dimensions to control the power of the spectral channels*** reflected to selected output ports, as indicated by the amendments to Claim 1 in the Preliminary Amendment. (Ex. 1002 at 81-82.)

In its efforts to distinguish over Bouevitch, Patentee's first amendment specified that the beam-deflecting elements must be controllable in two dimensions. This amendment corresponds to a mirror tilting in two axes rather than one. As for the second amendment, Patent Owner added a use clause stating that the beam-deflecting elements could be used to control power. As explained in the claim construction section (§ VII, below), use clauses are not limiting, and have no impact on an invalidity analysis. Claim 1 of the '750 patent as amended, with the amendments underlined, is shown in Table 1.

Table 1	
1	An optical add-drop apparatus comprising
1a	an input port for an input multi-wavelength optical signal having first spectral channels;
1b	one or more other ports for second spectral channels; an output port for an output multi-wavelength optical signal;
1c	a wavelength-selective device for spatially separating said spectral channels;
1d	a spatial array of beam-deflecting elements positioned such that each element receives a corresponding one of said spectral channels, each of said elements being individually and continuously controllable <u>in two dimensions</u> to reflect

	its corresponding spectral channel to a selected one of said ports <u>and to control the power of the spectral channel reflected to said selected port</u>.

The Patentee made almost identical amendments to the 3 other independent claims.

Through the Patentee's admissions about Bouevitch, the Patentee also admitted that Bouevitch disclosed all the elements of at least claim 1, except for 2-axis mirrors. The Patentee first admitted that Bouevitch anticipated the pre-reissue version of claim 1 as it appeared in the '750 patent. Following that, the only amendments the Patentee added to the claim were 2-axis mirrors and their intended use for power control. Because the intended use language is not limiting, as discussed in the next section, the Patentee admitted that Bouevitch disclosed all limitations but for 2-axis mirrors. (*See* MPEP § 2217 ("admissions by the patent owner in the record as to matters affecting patentability may be utilized during a reexamination") (citing 37 CFR 1.104(c)(3)).)

VII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)

A. Legal Overview

A claim subject to *inter partes* review ("IPR") is given its "broadest reasonable construction in light of the specification of the patent in which it appears." 37 C.F.R. § 42.100(b). Except as expressly set out below, Petitioner construes the language of the claims to have their plain and ordinary meaning.

B. [Controllable] "in two dimensions"

The broadest reasonable interpretation ("BRI") for the term “in two dimensions” in light of the specification is "in two axes." As the claim states, the “beam-deflecting elements” are “controllable in two dimensions.” The ‘368 consistently describes these beam-deflecting elements as various types of mirrors which are rotated around the two axes in which the mirrors tilt to deflect light. The specification states, for example, that the beam-deflecting elements "may be pivoted about one or two axes.” (Ex. 1001 at 4:25-26, Abstract.) The specification also describes certain embodiments that use two-dimensional arrays of input and output ports. For these embodiments, the specification describes that the mirrors are required to tilt along two axes (“biaxially”) to switch the beams between the ports. (*Id.*, 4:25-29.) And further, the ‘368 patent explains how to control power by tilting the mirrors in two axes. (*Id.*, 16:36-51 (describing the combined use of major and minor “tilt axes” for power control & switching).)

C. “To control the power of the spectral channel…” and "to reflect its corresponding spectral channel to a selected one of said ports" (Claims 1-16); "whereby a subset of said spectral channels is directed to said drop ports" (Claim 15); and “for monitoring power levels” and “for controlling said beam-deflecting elements” (Claim 3)

Each of the above terms is a mere statement of intended use and is not limiting under a BRI for apparatus claims 1-16. The Federal Circuit stated that "apparatus claims cover what a device *is*, not what a device *does*." *Hewlett–*

Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1468 (Fed. Cir. 1990). "An intended use or purpose usually will not limit the scope of the claim because such statements usually do no more than define a context in which the invention operates." *Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1345 (Fed. Cir. 2003); *see also Paragon Solutions, LLC v. Timex Corp.*, 566 F.3d 1075 (Fed. Cir. 2009); MPEP §§ 2114, 1414.)

The BPAI has also had the opportunity to address use clauses. In *Ex parte Kearney,* the BPAI stated that use clauses need not be considered when evaluating the validity of a claim. *Ex parte Kearney*, 2012 Pat. App. LEXIS 2675, at *6 (BPAI 2012) ("our reviewing court has held that the absence of a disclosure relating to function does not defeat a finding of anticipation if all the claimed structural limitations are found in the reference.")

The above phrases are non-functional use clauses because they say nothing about the structure of the apparatus. Unlike claim limitations reciting "***configurable to*** [perform a function]," which in some cases inform about the configuration of a part of the apparatus, the term at issue in the '368 patent says nothing about what the apparatus is. Instead, the claus speaks only to what it might do. Petitioner asks that the Board find the above phrases non-limiting.

D. "So as to combine selected ones of said spectral channels into an output" and "so as…to control the power" (claims 17-22)

The above phrases are not limiting for method claims 17-22 under the BRI because each expresses nothing more than the intended result of a method step. A "whereby clause in a method claim is not given weight when it simply expresses the intended result of a process step positively recited." *Minton v. Nat'l Ass'n of Sec. Dealers, Inc.*, 336 F.3d 1373, 1381, 67 USPQ2d 1614, 1620 (Fed. Cir. 2003); MPEP 2111.04 (listing "whereby" as one of several terms that raise questions as to any limiting effect).

Here, instead of a "whereby" or a "whereas" clause, the Patentee chose to use the term "so as," which just as clearly designates an intended result as "whereas." *See Regents of University of California v. Micro Therapeutics, Inc.*, Case No. C03–05669, 2007 WL 734998, *18 (N.D. Cal. Mar. 2, 2007) ("Thus, a 'so that clause' is equivalent to a 'whereby clause' in a method claim. A 'whereby clause' in a method claim that merely states the results of the limitations in the claim adds nothing to the substance of the claim"). Petitioner asks that the Board find the above terms non-limiting.

E. "Continuously controllable"

The BRI for "continuously controllable" in light of the specification is "under analog control." This definition is consistent with the use of the term in the specification, which describes how "analog" means are used to effect continuous control of the mirrors. The patent explains that "[a] distinct feature of the channel

micromirrors in the present invention, in contrast to those used in the prior art, is that the motion…of each channel micromirror is under ***analog control*** such that its pivoting angle can be ***continuously adjusted***." (*Id.*, 4:7-11; emphasis added). Another passage in the specification states that "[w]hat is important is that the pivoting (or rotational) motion of each channel micromirror be individually ***controllable in an analog manner, whereby the pivoting angle can be continuously adjusted*** so as to enable the channel micromirror to scan a spectral channel across all possible output ports." (*Id.*, 9:9-14; emphasis added). Yet another passage states that "channel micromirrors 103 are individually controllable and movable, e.g., pivotable (or rotatable) under analog (or continuous) control." (*Id.*, 7:6-8).

F. "Servo-control assembly" (Claims 3 & 4)

The BRI for the term "servo control assembly" in light of the specification is "feedback-based control assembly" This definition is consistent with the use of the term in the specification, which equates servo control with use of a feedback loop. For example, when describing its "servo control," the '368 patent teaches a spectral monitor that provides "feedback" control for the mirrors. "The servo-control assembly 440 further includes a processing unit 470, in communication with the spectral monitor 460 and the channel micromirrors 430 of the WSR apparatus 410. The processing unit 470 uses the power measurements from the

spectral monitor 460 ***to provide feedback control*** of the channel micromirrors 430." (*Id.*, 11:18-24 emphasis added.) In another passage, the ‘368 patent states that the servo-control assembly “serves to monitor the power levels of the spectral channels coupled into the output ports and further provide control of the channel micro mirrors on an individual basis, so as to maintain a predetermined coupling efficiency of each spectral channel.” (*Id.*, 4:45-52.)

Moreover, in the figure that the `368 patent labels “servo-control assembly,” the ‘368 patent shows a controller which takes measurements of the output power and moves the mirrors to further adjust that power—a typical feedback loop. (*Id.*, Fig. 4a; Ex. 1014.) Also confirming this BRI, the feedback-based control described in the ‘368 patent achieves the same goals that the patent ascribes to its “servo-control assembly”—dynamic adjustment to account for changing conditions, such as the possible changes in alignment of the parts within the device. (Ex. 1001 at 4:56-67.)

Petitioner is aware that a “servo” can sometimes refer to a servomotor, which is a type of actuator. But that is not what the patent is referring to here with its use of servo in the context of a “servo-control assembly.” Should Capella attempt to change the “servo-control assembly” to refer instead to some “servo”-based *actuation* mechanism (as opposed to a ***control*** mechanism), there is no support for that in the specification. The ‘368 patent nowhere address the details

of the MEMS mirror actuation, and instead discusses “servo-control” and “servo-based” strictly in terms of the ***control*** system used to move the mirrors, not the actuation mechanism that physically moves them. (*See*, *e.g.*, Ex. 1001 at 4:45-, 5:5, 6:3-16, 10:62-12:49.)

G. “Spectral monitor"(claim 3)

The BRI for the term “spectral monitor” is "a device for measuring power." This definition is consistent with the use of the term in the specification, where the monitor is used to measure the power of the output signals. The spectral monitor is shown in Figure 4A measuring output power, and the specification describes the spectral monitor as providing power measurements as part of a feedback loop. (*Id.*, 11:14-23 (“processing unit 470 uses the power measurements from the spectral monitor 460 to provide feedback control").) In addition, the only requirement for the spectral monitor that the patent identifies is that the monitor "be capable of detecting the power levels of spectral components in a multi-wavelength optical signal." (*Id.*, 11:58-61.)

H. “Beam-focuser" (claim 11)

The BRI for the term “beam-focuser” in light of the specification is "a device that directs a beam of light to a spot." This definition is consistent with the use of the term in the specification and the claims. The Summary of the ‘368 patent states that the “beam-focuser focuses the spectral channels into

corresponding spectral spots." (*Id.*, 3:63-64.) The specification also explains that the beams of light are "focused by the focusing lens 102 into a spatial array of distinct spectral spots (not shown in FIG. lA) in a one-to-one correspondence." (*Id.*, 6:65-7:5.) The MEMS mirrors are in turn "positioned in accordance with the spatial array formed by the spectral spots, such that each channel micromirror receives one of the spectral channels." (*Id.*) Claim 11 echoes this, saying that the beam focuser is "for focusing said separated spectral channels onto said beam deflecting elements."

Capella may attempt to narrow "beam-focuser" to a particular one of the embodiments in the '368 patent. For example, one embodiment of a "beam focuser" in the patent corresponds to element 103 in Fig. 3, which depicts a lens focusing light onto a MEMS mirror array. However, the specification also notes that the "focuser" has a broader meaning than simply a lens, and instead, "[t]he beam-focuser may be a single lens, an assembly of lenses, or other beam-focusing means known in the art." (*Id.*, 4:20-22.) Thus, the BRI of "beam-focuser" covers any device capable of directing a beam of light to a spot.

VIII. CLAIMS 1-6, 9-13, AND 15-22 OF THE '368 PATENT ARE UNPATENTABLE

The Petitioned Claims are obvious over Bouevitch in view of Smith (for Ground 1), and also further in view of Lin (for Ground 2). Claim 12 is also obvious under Grounds 1 or 2 in further view of Dueck (Grounds 3 & 4).

Petitioner provides below (1) an overview of the status of Bouevitch, Smith, Lin and Dueck as prior art, (2) a general description of Bouevitch and Smith, (3) motivations to combine these references; and (4) a description of how these references disclose each Petitioned Claim on an element-by-element basis.

A. Smith, Lin and Dueck are all prior art to the '368 patent

Bouevitch and Smith both qualify as prior art under 35 U.S.C. § 102(e) (pre-AIA), because each reference is a patent that issued from an application filed in the United States prior to the earliest application to which the '368 patent could claim priority. The earliest facial priority date for the '368 patent is based on a provisional application filed on March 19, 2001.

Bouevitch is entitled to a 102(e) prior art date of at least its filing date of December 5, 2000. This date is before the earliest '368 priority date.

Smith is entitled to a 102(e) prior art date of September 22, 2000, the filing date of its earliest provisional application. *See, e.g., In re Giacomini*, 612 F.3d 1380 (Fed. Cir. 2010) (holding that a 102(e) reference is prior art as of the filing date of its provisional application, if that provisional provides proper written description support for the claimed invention). The portions of the Smith Patent that Petitioner relies on for its invalidity arguments are fully supported by the Smith Provisional. (Marom Decl., at ¶¶ 130-132.) To demonstrate proper written description as required by *In re Giacomini*, the analysis below includes citations to

both the Smith Patent and the Smith Provisional. Accordingly, Smith predates the earliest '368 priority date.

Dueck is entitled to the 102(b) prior art date of its filing: Dec. 13, 1997. Dueck describes various diffraction gratings for use in WDM devices.

Lin is entitled to the 102(b) prior art date of its filing: Sept. 29, 1995. Lin describes a MEMS optical switch including continuous, analog, control of mirrors.

B. Overview of the Bouevitch Prior Art

Bouevitch explicitly discloses every element of the 4 independent claims of the '368 patent (and most dependent claims) except for the use of mirrors rotatable in two axes. Bouevitch discloses mirrors that are rotatable in a single axis.

Bouevitch discloses a configurable optical add/drop multiplexer (COADM) that uses MEMS mirrors for routing signals and controlling power. (*Id.*, Abstract) By tilting its MEMS mirrors, the Bouevitch COADM switches an input spectral channel to either an output port or a drop port. (*Id.*, 14:14-15:18, Fig. 11.) The Bouevitch COADM can also add a new channel in place of a dropped channel. (*Id.*)

The Bouevitch COADM controls the power of its output channels by tilting beam-deflecting elements (mirrors) at varying angles to control power. The "degree of [power] attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)." (*Id.*, 7:23-37.) Bouevitch refers to this

power control process as Dynamic Gain Equalizer (DGE) and discloses that the DGE is used "to control the relative power levels in respective channels" of a WDM system. (*Id.*, 1:24-25.)

Bouevitch's COADM uses MEMS mirrors with 1 axis of rotation. (*E.g.*, Ex. 1003 at 7:23-37 (describing attenuation by tilting mirrors along one axis).)

C. Overview of the Smith Prior Art

Like Bouevitch, Smith is directed at MEMS-based COADMs for optical communications. Smith discloses a COADM that uses MEMS mirrors rotatable in one and two axes for switching and power control in WDM optical communications. (Ex. 1004 at Abstract.) The Smith Provisional similarly describes "a mirror array with elements that can be rotated in an analog fashion about two orthogonal axes," with one axis for switching, and one axis for power control. (*Id.*, p. 6.) The Smith Patent notes that the 1-axis and 2-axis mirrors are interchangeable. (*Id.*, 17:58-67, 16:55-58.) Thus, to the extent Bouevitch does not disclose 2-axis mirrors and their intended use for power control, both the Smith Patent and the Smith Provisional each does so.

D. PHOSITA had ample motivation to combine Bouevitch with Smith, including the motivations disclosed in both references

A person having ordinary skill in the art ("PHOSITA") at the time of the '368 patent would have been an engineer or physicist with at least a Master's degree, or equivalent experience, in optics, physics, electrical engineering, or a

related field, including at least three years of additional experience designing, constructing, and/or testing optical systems. (Ex. 1028 at ¶ 20.) To the PHOSITA, Bouevitch and Smith were combinable for purposes of establishing obviousness under 35 U.S.C. § 103(a). (*Id*., ¶ 28-47.) Most of the *KSR* obviousness rationales support combining these two references. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421 (2007); MPEP § 2141.

First, the use of Smith's 2-axis mirrors in Bouevitch's system is a simple substitution of one known, closely-related element for another that obtains predictable results. The 1-axis mirrors of Bouevitch and the 2-axis mirrors of Smith were known to be interchangeable. (Ex. 1028 at ¶¶ 39-41.) Smith expressly acknowledges this interchangeability: "in comparison to the two-axis embodiment, single axis systems may be realized using simpler, single axis MEMS arrays but suffer from increased potential for crosstalk between channels." (Ex. 1005 at 11; Ex. 1004 at 18:17-18.) Smith also states that "both single and dual axis mirror arrays may be used in a variety of switching configurations, although the two-axis components are preferred." (Ex. 1005 at 11; Ex. 1004 at 16:55-58; Ex. 1007 at 4:17-19 (claiming a crossconnect with "an array of tiltable mirrors comprising a plurality of mirrors, each mirror being tiltable ***about at least one*** tilting axis") (emphasis added).)

Second, combining Bouevitch with Smith is nothing more than the use of

known techniques to improve similar devices. PHOSITA could use the 2-axis mirrors of the Smith ROADM as a replacement for the 1-axis mirrors in the similar Bouevitch ROADM. (Ex. 1028 at ¶¶ 42-44.) Each reference discusses devices in the same field of fiber optic communications (Ex. 1003 at 1:18; Ex. 1004 at 1:10-15; Ex. 1005 at 1). Each reference is directed at the same application in that field—optical switching for multi-wavelength WDM communications. (Ex. 1003 at Abstract; Ex. 1004 at Title.) Each reference discloses the same type of optical switch—a COADM. And each COADM uses the same type of WSS for switching—a MEMS-based optical add/drop multiplexer. As a result, using the known 2-axis mirrors in the Bouevitch ROADM is nothing more than the use of known techniques to improve similar devices. (Ex. 1028 at ¶¶ 42-44.) And using 2-axis mirrors for power control instead of 1-axis mirrors would yield the same predictable result for power control if used in the MEMS-based switch of Bouevitch. (Ex. 1028 at ¶¶ 43-45.) Rotation about either 1 or 2 axes would result in controllable misalignment to alter power. (Ex. 1028 at ¶¶ 43-45.)

Third, it would be obvious to try Smith's 2-axis mirrors in Bouevitch because 2-axis mirrors were among a small number of identified, predictable solutions, and PHOSITA had a high expectation of success with either. (Ex. 1028 at ¶ 45.) There are only two options for tilting MEMS mirrors: 1-axis and 2-axis mirrors. (Ex. 1028 at ¶ 45) Because Smith already disclosed the use of 2-axis

mirrors (which were available by the '368 patent's priority date), PHOSITA would have a high expectation of success to try 2-axis mirror control in Bouevitch, both for switching and power control. (Ex. 1028 at ¶ 45.) And the impact of tilting in 1 or 2 axes for the steering of a light beam is entirely predictable. (*See id.*, '368 patent, 4:25-29 (2-axes allows 2-D steering); Ex. 1028 at ¶ 45.)

Fourth, Smith and Bouevitch, as well as other contemporaneous prior art, provide explicit motivations to combine the references. For example, PHOSITA would be motivated to use the 2-axis mirrors of Smith with the system of Bouevitch to reduce crosstalk in attenuation. (Ex. 1004 at 18:17-18; Ex. 1028 at ¶¶ 46-47.) Crosstalk is reduced by performing beam misalignment in a different axis than the axis used for switching. (*Id.*; Ex. 1004 at 16:55-59, 18:18-25.) The PHOSITA would also be motivated to use the 2-axis mirrors of Smith with the Bouevitch COADM to increase port density. (Ex. 1028 at ¶¶ 47, 69.) Compact, two-dimensional arrays of fiber ports can be utilized when two-axis mirrors allow beams to be steered in two dimensions to those ports. (Ex. 1028 at ¶ 47; Ex. 1003 at 2:9-21; Ex. 1007 at 3:10-11; Ex. 1009 at 2:1-16.)

Finally, the Patentee's admission during prosecution that claim 1 was invalid over Bouevitch "further in view of one or more of" Ma, Jin, and Wagener also confirms that one of skill in the art would have been motivated to combine Bouevitch with Petitioner's other references which are similar to Ma, Jin, and

Wagener. (*See* Ex. 1002 at 81-82.) By admitting that claim 1 was ***invalid*** over Bouevitch "further in view of one or more of" Ma, Jin, and Wagener, the Patentee also admitted the ***combinability*** of such references. This admission is important because Smith and other references that Petitioner combines with Bouevitch here are directed at the identical technology area as Ma Jin, & Wagener—MEMS-based optical switches for WDM. (*See* Ex. 1023 at 1:6-11, Ex. 1024 at 1:11-20, 2:27-39, Ex. 1025 at 3:20-34, 5:32-43.) Thus, the references Petitioner relies on here are also combinable.

E. Bouevitch and Smith Render Obvious All Petitioned Claims

The Petitioner identifies below how Bouevitch in view of Smith discloses each element of the Petitioned Claims, as well as element-specific motivations to combine the two references (and Lin and Dueck). Given the similarity of many of the Petitioned Claims, some of the explanations below refer to earlier discussions of the same or similar claims to avoid repetition. In such cases, the prior referenced discussions are incorporated fully by reference in the later explanations.

1. Claim 1 – Grounds 1 and 2

The section addresses claim 1 first under Petitioner's Ground No. 1 of Bouevitch+Smith, and then under Ground No. 2 of Bouevitch+Smith+Lin.

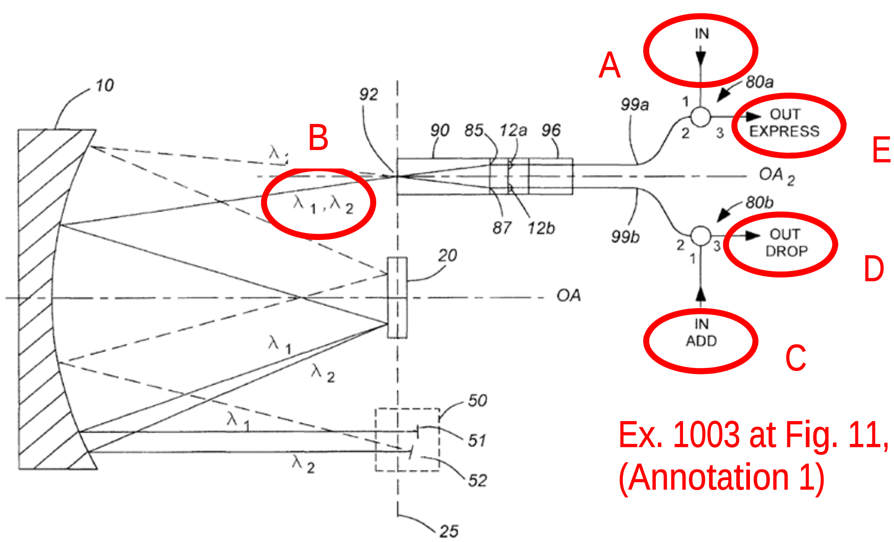
(1) Claim 1 - preamble

The preamble of claim 1 recites "[a]n optical add-drop apparatus

comprising....” Bouevitch discloses a “Configurable Optical Add/Drop Multiplexer (COADM).” (Ex. 1003 at Abstract; *see also Id.*, 5:15–20; 14:14-21; Figs. 1, 11; 3:9-63 (discussing methods of using the COADM).)

(2) Claim element 1[a] - input port

The first limitation of claim 1 recites “an input port for an input multi-wavelength optical signal having first spectral channels.” The Patentee admitted in the reissue that Bouevitch discloses this element. (§ VI, above.) The explanation below confirms that the Patentee was correct. Bouevitch discloses an input port “IN,” annotated as “A” in Fig. 11-Annotation 1, included below. An optical signal is “launched into” the “IN” port. (*Id.*, 14:38–41.) That signal is a multi-wavelength signal with a first spectral channel λ_1 and a second channel λ_2, as shown at annotation “B” of Fig. 11-Annotation 1 (*Id.*, Fig. 11, 14:39-42, 10:56-61)



Ex. 1003 at Fig. 11, (Annotation 1)

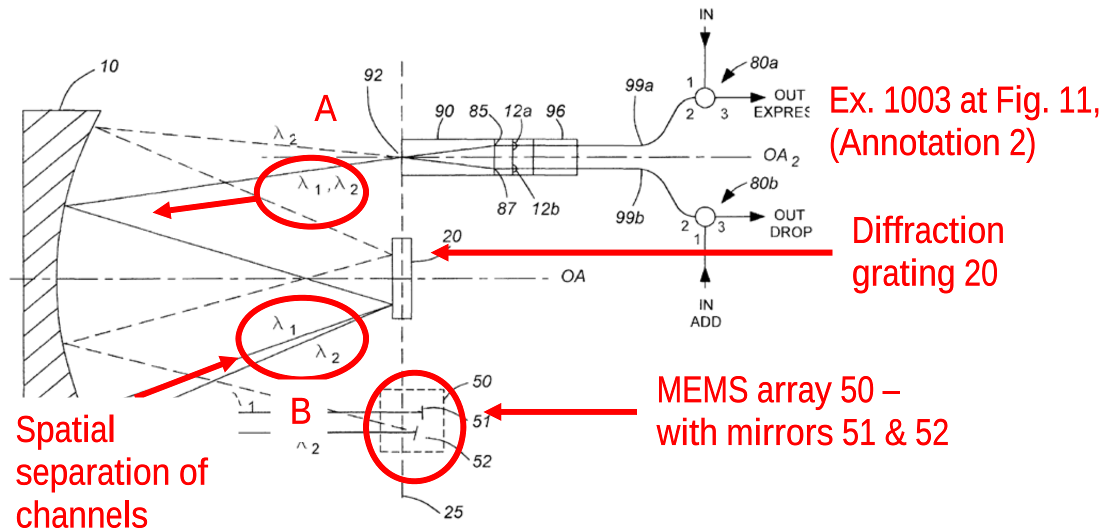
(3) Element 1[b] – Output & other ports for 2nd channels

Other Ports: The first part of limitation 1[b] recites: "one or more other ports for second spectral channels." Bouevitch discloses two ports in addition to the input and output ports. Bouevitch labels one port as 80b, port 1, "IN ADD" (annotated as "C" in *Id.*, Fig. 11-Annotation 1, above). Another is labeled as 80b, port 3, "OUT DROP" (annotated as "D"). (*Id.*) In one example, first spectral channel λ_2 exits the OUT DROP port, and Bouevitch adds a new second channel on the same wavelength λ_2 at the IN ADD port. (*Id.*, 14:27-65.) Although both the added and the dropped channels use the same wavelength, they are separate channels. (Ex. 1028 at ¶ 51.) Bouevitch discloses the "in/out/add/drop ports" as part of its "configurable add/drop multiplexor". (*Id.*, 10:56-61, 1:11-15.)

Output Port: The second part of limitation 1[b] recites: "an output port for an output multi-wavelength optical signal." Bouevitch discloses an output "OUT EXPRESS" output port (annotated as "E," in Fig. 11-Annotation 1, above) wherein a multi-wavelength signal including one of the original input channels (wavelength λ_1) is combined with an added channel (λ_2), which together exit the output port 80a(3). "[T]he added optical signal corresponding to λ2 is combined with the express signal corresponding to λ1. The multiplexed signal…returns to port 2 of the first circulator 80a where it is circulated out of the device from port 3." (*Id.*, 15:14-18; Fig. 11.)

(4) Element 1[c] - wavelength-selective device

The next element, 1[c], requires "a wavelength-selective device for spatially separating said spectral channels." Diffraction grating 20 in Bouevitch Fig. 11 is such a device. Figure 11 shows that the grating spatially separates combined channels $\lambda_1\lambda_2$ ("A" at Fig. 11-Annotation 2, below) into separated channels ("B"):



Bouevitch states, "[t]he emerging beam of light λ_1 λ_2, is transmitted to an upper portion of the spherical reflector 10, is reflected, ***and is incident on the diffraction grating 20, where it is spatially dispersed into two sub-beams of light carrying wavelengths λ_1 and λ_2, respectively***." (Ex. 1003 at 14:48-53 (emphasis added); 8:10–22; *see also* Ex. 1028 at ¶ 53, ¶¶ 102-104.)

(5) Element 1[d] – 2-axis beam-deflecting elements

This final element of claim 1 has three subparts. Bouevitch teaches the first two, and Smith teaches the third. Each subpart is discussed in turn, below.

Beam-deflecting Elements: The first part of element 1[d] recites: "a spatial

array of beam-deflecting elements positioned such that each element receives a corresponding one of said spectral channels." Bouevitch discloses this element as MEMS mirror array 50 in Fig. 11-Annotation 2, above. Bouevitch positions its MEMS mirrors to receive and reflect the beams of light carrying the respective spectral channels dispersed by the diffraction grating. Bouevitch discloses "modifying and reflecting a beam of light spatially dispersed by the dispersive element" where, for COADM operations, the "modifying means is preferably a MEMS array 50." (Ex. 1003 at 3:42–45; 14:26-27.) Each mirror in the MEMS array (elements 51 and 52 for Fig. 11-Annotation 2, above) reflects a separate, corresponding beam of light (channels λ_1 & λ_2 respectively) such that the channel reflected by mirror 51 is passed though, and the channel reflected by 52 is dropped. (Ex. 1003 at 14:52-63, Fig. 11.)

Individually / Continuously Controllable: The second part of limitation 1[d] recites wherein each of the elements of the array is "individually and continuously controllable in two dimensions to reflect its corresponding spectral channel to a selected one of said ports." The BRI of controllable "in two dimensions" means controllable "in two axes." The BRI of "continuously controllable" is "under analog control."

First, Bouevitch discloses "individual" control of each mirror in MEMS array 50. "[E]ach sub-beam of light…is transmitted to separate reflectors 51 and

52 of the MEMS array 50." (*Id.* at 14:52-63, 10:47-51, Fig. 11-Annotation 2). Each reflector is individually controlled in one axis to deflect the respective beam to either the output or the drop port. (*Id.*; *see also* Ex. 1028 at ¶ 57.)

Second, Bouevitch indicates that its reflectors are "continuously" controllable because (as discussed below) the amount of power the device attenuates is a direct (e.g., analog) function of the angle of the deflector in that one axis. (*Id.*, 7:35-37 ("The degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)"; Ex. 1028 at ¶ 58.)) Bouevitch also describes the attenuation resulting from the deflector as "variable." (*Id.*, 12:59-60; Ex. 1028 at ¶ 58.)) Further, in addition to the disclosure of "continuously" controlling in Bouevitch, Smith also expressly discloses this element.

Smith teaches continuous control of its MEMS mirrors in an analog manner, where the force used to tilt the mirrors is "approximately ***linearly*** proportional to the magnitude of the applied voltage. (*Id.*, 15:41-42; emphasis added, 6-35; 17:1-23; Ex. 1028 at ¶ 59.) This linear proportionality is another way of describing a continuous, analog, relationship between the voltage driving the mirrors and the resulting mirror angle. (Ex. 1028 at ¶ 59.) The Smith Provisional echoes this disclosure:

"[a]ccording to a preferred embodiment of the invention, the optical

> ***throughput of each wavelength channel may be controlled by using a mirror array with elements that can be rotated in an analog fashion about two orthogonal axes***. Angular ***displacement in a first, switching plane, is used to perform an OXC, ADM or other switching function*** while ***angular displacement about the orthogonal axis is used for power control***." (*Id.* at 6 (emphasis added); *see also id.*, 12:29-42, Fig. 9, 9:6-57, 10:37-43, 11:2-11, 14:49-65, 16:8-51.)

(6) Ground 2 – Bouevitch + Smith + Lin

Petitioner asserts that Ground 1 is sufficient for institution. Bouevitch + Smith discloses all claimed elements, including the "continuously" limitation. Ground 2 adds one additional reference, Lin, to Ground 1 to further address the "continuously" limitation. If the Board decides that Bouevitch + Smith does not adequately disclose the "continuously" limitation, then the Board should adopt Ground 2.

Under Ground 2, U.S. Patent No. 5,661,591 to Lin also teaches continuous, analog control of MEMS mirrors. (Ex. 1028 at ¶ 61.) As discussed below, it would be obvious to combine Lin's continuous, analog control with Bouevitch and Smith. For example, Figure 3B of Lin shows a graph disclosing the continuous deflection angle of MEMS mirrors as a function of the voltage applied to affect that deflection. Figure 3B shows the relationship as continuous and linear:

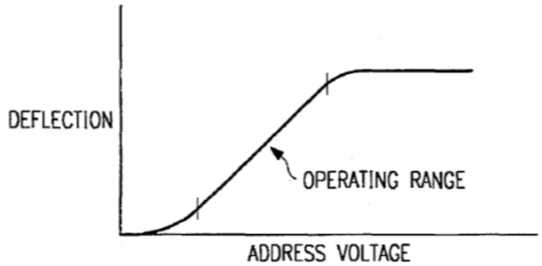


FIG. 3B

To the extent Bouevitch does not fully disclose continuous (analog) mirror control, it also would have been obvious to substitute one control method for the other, including substituting Smith's or Lin's analog control into the COADM of Bouevitch. (Ex. 1028 at ¶¶ 62-65.) The PHOSITA would combine the teachings of these references at least for the reasons that (1) continuously controlled mirrors were known to be interchangeable with discrete-step mirrors; (2) continuously controlled mirrors allow arbitrary positioning of mirrors and can more precisely match the optimal coupling value; and (3) Lin specifically teaches that its analog, continuous MEMS mirrors would be useful in optical switching applications like Bouevitch's and Smith's ROADM devices. (Ex. 1010 at 2:6-9; Ex. 1028 at ¶ 62.)

In addition, analog (continuous) control of the mirrors would be obvious to try because there are only two general options for such control—either analog (continuous) or discrete (step-wise) control. (Ex. 1028 at ¶ 63.) For example, Lin discusses analog control as the alternative to binary (discrete) control of mirrors to increase the precision of the mirror placement. (*Id.*, 2:7-9; 3:41-57; Ex. 1028 at ¶¶ 61-62.) With only two options, both of which were known in the prior art, and

both of which were suggested as working solutions for control, PHOSITA would have expected that trying analog control would work well in the device of Bouevitch. (Ex. 1028 at ¶¶ 62-65.)

(7) 2-axis beam-deflecting elements

Returning now to both Grounds 1 and 2, the only portion of this part of element 1[d] arguably not taught by Bouevitch is a beam deflecting element with a second dimension ("axis" under Petitioner's BRI) of control. But as discussed in § VIII.C, Smith discloses a 2-axis beam deflecting element. (*See also* Ex. 1028 at ¶ 66.) In particular, Smith describes a "multi-wavelength…optical switch including an array of mirrors tiltable about two axes, both to control the switching and to provide variable power transmission." (Ex. 1004 at Abstract; *Id.*, 7:1-3 (describing "switching elements controllable in two different scales or dimensions"), 7:32-44, Fig. 14, 8:19-20 ("FIG. 14 is plan view of two-axis tiltable mirror usable with the invention."), 14:49-65.) Similarly, the Smith Provisional describes the use of two-axis mirrors in its add/drop multiplexor (ADM) with tilting in one axis to switch add/drop beams, and in a second axis to control power. (Ex. 1005 at 6 ("each wavelength channel may be controlled by using a mirror array with elements that can be rotated in an analog fashion about two orthogonal axes. Angular displacement in a first, switching plane, is used to perform an OXC, ADM or other switching function while angular displacement about the orthogonal axis is used

for power control.”))

As discussed in § VIII.D, above, it would be obvious (and PHOSITA would be motivated) to exchange the 1-axis mirrors in Bouevitch with the 2-axis mirrors of Smith because the two were known to be interchangeable. The exchange would achieve benefits such as reduced device size (by eliminating gaps incorporated between ports for attenuation), allowing for no-crosstalk (‘hitless’) switching operation by moving the light beam around to avoid intermediate fiber ports when switching. (Ex. 1028 at ¶ 67.). As discussed below in § VIII.E.1(8), 2-axis mirrors also have benefits for power control.

Replacing Bouevitch's 1-axis mirrors with Smith’s 2-axis mirrors had the known benefit of minimizing the resulting device's size, which is desirable in optical devices. (Ex. 1003 at 2:9-21; Ex. 1028 at ¶ 68.) Size reduction results from "minimal spacing between crossconnect components," (Ex. 1006 at 3:10-11), and PHOSITA knew that 2-axis mirrors allow for beam-steering between more compactly-spaced input/output ports arranged as a 2-D array. (Ex. 1009 at 1:65-2:13.) The patentee itself acknowledged the need for 2-axis mirrors in the '368 patent, saying that when the input and output ports are arranged in a 2-D array, “the channel micromirrors must be pivotable biaxially." (*Id.*, 4:26-29; *see also* Ex. 1028 at ¶ 68.); § VIII.D, above.) Others also recognized the need for 2-axis mirrors. (Ex. 1028 at ¶¶ 68-69.)

With respect to the last term of this portion of 1[d] ("to reflect its corresponding spectral channel to a selected one of said ports"), that term is merely an intended use, and should not be limiting, as discussed in the BRI section.

In an abundance of caution, Petitioner addresses this use limitation. Both Bouevitch and Smith describe how the goal of controlling the MEMS mirrors is to effect the add/drop process, which includes reflecting the spectral channels to selected add/drop ports. (*See, e.g.*, Ex. 1003 at 14:66-15:18; Ex. 1004 at Fig. 5, 8:47-59, 12:4-12, 10:37-44; *see also* Ex. 1005 at 7; Ex. 1028 at ¶ 70.)

(8) Power Control using 2-Axis Mirrors:

The third part of element 1[d] recites wherein each of the beam-deflecting elements is controllable "to control the power of the spectral channel reflected to said selected port." As discussed in the BRI section, this statement of intended use should not be limiting in the first instance. Again, in an abundance of caution, Petitioner addresses this language as if it were limiting.

Bouevitch discusses power control by tilting one-axis mirrors to effect a slight misalignment between the beam and the output port. Bouevitch shows how each MEMS mirror controls the power of a "respective" channel, where "the degree of [power] attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)." (*Id.* 1:24-27, 7:23-37; *see also Id.*, 1:21-24, 50-53; 5:16-46; 2:22-25; Abstract; see also Ex. 1028 at ¶ 71.)

Smith discusses two-axis (two dimensional) tilting for both switching and power control, including continuous control of such mirrors. (Ex. 1028 at ¶ 72.) The Smith Patent teaches a "two-dimensional array of two-axis tiltable mirrors." (*Id.*, 16:9-11.) Smith switches with mirror rotation in one axis, and control powers with mirror rotation in a second axis. The "principal switching operations us[e] the one mirror tilt axis," while "[t]he other mirror tilt axis, the minor axis, can be used for power adjustment." (*Id.*, 16:9-11, 34-51; *see also* Ex. 1005 at 6 ("Angular displacement in a first, switching plane, is used to perform an OXC, ADM or other switching function while angular displacement about the orthogonal axis is used for power control.").)

The PHOSITA would be motivated to use the 2-axis system of Smith within the system of Bouevitch for power control. (Ex. 1028 at ¶ 73.) First, power control was desirable generally and would be just as desirable after switching to 2-axis mirrors for the benefits cited above. Bouevitch notes both the desirability of power equalization across spectral channels, and the need for devices that perform both power control and add/drop functions. (Ex. 1003 at 1:18; 1:50-42.) The patentee also recognized this, claiming that ("spectral power-management capability is essential in WDM optical networking applications.") (Ex. 1001 at 11:21-24; *see also* Ex. 1028 at ¶ 73.) Second, while power control in an axis orthogonal to the switching axis is not absolutely necessary, "second axis tilting is nonetheless

desired for optimization." (Ex. 1004 at 16:55-59.) This is because a ROADM can control power by moving a beam off-center of a port in an axis orthogonal to the switching axis without the risk of the signal bleeding into a port that is adjacent to the output port along the switching axis. (Ex. 1028 at ¶ 74.); Ex. 1004 at 18:18-25.) Third, using one axis for power control would allow designers to use a finer-grained movement for power (which was more sensitive to small changes in mirror angle) than the coarser-grained control that accommodates the wider-range of potential tilt angles useful for switching. (Ex. 1004 at 17:53-18:25, Ex. 1028 at ¶ 75.)

2. Claim 2

Claim 2 recites "the optical add-drop apparatus of claim 1 further comprising a control unit for controlling each of said beam-deflecting elements." Bouevitch must contain a control unit for controlling the tilt on the individual mirrors (50, 51) in the MEMS array (50). (Ex. 1028 at ¶ 76.) But rather than rely on this inherent property of Bouevitch, Petitioner will address this element in terms of obviousness.

It would be obvious to PHOSITA to add a control unit to Bouevitch, including the Smith control unit, because the Bouevitch device is required to function with some type of control unit. The "selective switching" that Bouevitch performs with its MEMS mirrors would need to be performed by some type of

control unit, accepting commands for switching state change from a remote network controller, and in response issuing the actuation controls required for completing the switching function. (Ex. 1028 at ¶¶ 77-78.) Individual mirrors could not otherwise be manually aligned and maintained in accuracy necessary for the switching operation. (Ex. 1028 at ¶ 79.)

Moreover, Smith explicitly describes a control unit for its micromirrors. It would have been obvious to use the Smith control unit in Bouevitch. (Ex. 1028 at ¶ 80.) Smith explains that its "controller controls the driver circuit and hence the mirrors in a multiplexed control system." (Ex. 1004 at 11:18-21, Fig. 13 ("220 CONT"); *see also* Ex. 1005 at Fig. 11, pp. 6, 11). Smith gives an example of the controller as a "microprocessor [that] reads the optimum position settings for both axes of both the input and output mirrors." (*Id.*, 18:42-53.) Smith also uses its controller for power control in a feedback loop, as the controller "receives the outputs of the optical power monitor 218, or more specifically the detected optical intensities of the detector array, and accordingly readjusts the tilt positions of the micromirrors in the MEMS array." (*Id.*, 13:20-24; *see also Id.,* Figs. 8, 12, 8:3-4, 9:29-10:13, 13:20-14:15; Ex. 1005 at Fig. 4, 6 ("In this system, an optical performance monitor measures the power spectra at the switch output ports and transfers the data to a control processor. This unit generates electronic signals that adjust the angles of individual micro-mirrors within the switch to optimize the

output power spectra”)).

To the extent Bouevitch does not already disclose a “control unit,” adding the control unit of Smith (or other control units) to Bouevitch would have been obvious to the PHOSITA because control units such as microprocessors were known elements with almost universal applicability. (Ex. 1004 at 18:42-53; Ex. 1028 at ¶ 81.) The PHOSITA could have added such a control unit to Bouevitch with no change in the unit’s functions (to act as a controller of electronic elements). This addition would have yielded the predictable result of electronic control to one of ordinary skill in the art—a microprocessor-controlled COADM. (Ex. 1028 at ¶ 81.) And as previously stated, optical communications requires accurate switching. (Ex. 1028 at ¶¶ 79, 95.) A control unit that realigns the mirrors in configurable OADM would maintain that accuracy. (*Id*., Ex. 1028 at ¶¶ 76-81, 95.) A control unit would also affect the power feedback loop in a timely fashion. (*Id.; see also id.* at ¶ 90.)

3. Claim 3

Claim 3 has two parts, referred to in this section by the shorthand “servo-control assembly” and “spectral monitor.”

Servo Control Assembly: The “servo-control assembly” part of Claim 3 fully recites “wherein the control unit further comprises a servo-control assembly.” As discussed in the BRI section, above, the BRI of a “servo-control assembly” is a

"feedback-based control assembly." (*See* § VII.F, above.) The '368 patent explains how its servo-control assembly measures the actual output power and then uses that measurement in a feedback loop to further adjust the MEMS mirrors to ensure that the output power remains where it should. (*See* Ex. 1028 at ¶ 83.)

Smith discloses this servo control assembly in Fig. 8-Annotation 1, below, in the form of a "controller" ("B") that receives feedback from an "optical power monitor" ("A"). Specifically, Smith discloses a "microprocessor" that uses feedback of data from a power spectral monitor to generate signals to adjust the angles of individual micro-mirrors. (*Id.*, 18:42-53, 13:20-24.) "FIG. 8 is a block diagram of an optical switching system including an optical power monitor and feedback control" (*Id.*, 8:2-4; *see also* Ex. 1005 at Fig. 4):

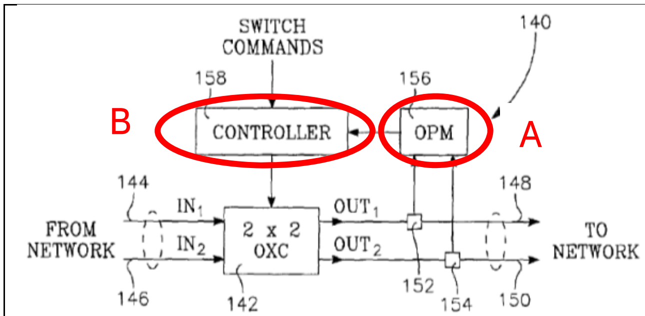
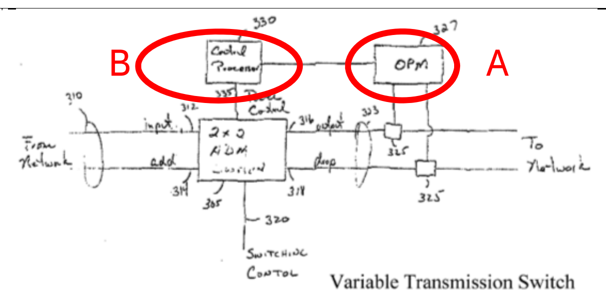


FIG. 8



Variable Transmission Switch
Figure 4

Smith Patent at Fig. 8 (Annotation 1)	Ex. 1005 at Fig. 4 (Annotation 1)

(*See also Id.*, 18:42-53, 13:20-24; *see also Id.*, Fig. 12, 8:3-4, 9:29-10:13, 13:20-14:15; Ex. 1005 at 11 ("This resulting feedback loop may be used to actively

optimize the power spectra of the signals leaving the ADM switch”)).

It would be obvious to PHOSITA to try the internal feedback loop in Smith for use in Bouevitch as an alternative to the "external feedback" for power control that Bouevitch explains should be eliminated. (*Id.* at 10:17-21; Ex. 1028 at ¶ 85.) This is obvious because the only alternatives to provide such feedback would be the use of (1) internal or (2) external feedback. (Ex. 1028 at ¶¶ 85-86.) Using the Smith internal feedback technique was known (*id.*), and one of skill would be motivated to do so to allow for the use of internal feedback to respond to power levels. (*Id.*; *see also* Ex. 1001 at 12:9-15 (“The electronic circuitry and the associated signal processing algorithm/software for such processing unit in a servo-control system are known in the art.”))

Spectral Monitor: The spectral monitor portion of claim 3 more fully requires the control unit to “include[] a spectral monitor for monitoring power levels of selected ones of said spectral channels, and a processing unit responsive to said power levels for controlling said beam deflecting elements.” The BRI for the term “spectral monitor” is "a device for measuring power."

Smith discloses a “spectral monitor” as “optical power monitor (OPM) 156” at “A” in the above Figure 8-Annotation 1 that measures power. Smith’s OPM 156 receives input from taps at 152 and 154. The OPM then provides optical power data to the controller 158. (*Id.*, 13:20-24; *see also id.,* Figs. 8, 9, 12, 8:3-4, 9:29-

10:21, 13:20-14:15, 9:42-49, 11:39-45; Ex. 1005 at 6, 11, Fig. 4; Ex. 1028 at ¶ 88.) The controller 158 in Fig. 8 can then adjust the output power on Out_1 and Out_2 by changing the tilt on the mirrors in the switch 142, thereby forming a feedback loop. (*Id.*, 9:29-33, Fig. 8, *see also* 18:42-53.)

As for the use phrases, a spectral monitor "for monitoring…" and a processing unit "for controlling…," the quoted phrases are non-limiting and need not be shown in the prior art. (§ VII.C) But in an abundance of caution, Petitioner addresses the phrases. Smith discloses that its spectral monitor is for monitoring the power of the optical outputs by tapping the outputs at taps 152 and 154. (Fig. 8-Annotation 1, Ex. 1004 at 9:29-49; Ex.1005 at Fig. 11, pp. 6, 11; Ex. 1028 at ¶ 90.) And Smith also describes how its microprocessor-based controller controls mirrors by "readjust[ing] the tilt positions of the micromirrors in the MEMS array." (*Id.*, 13:20-24, 18:42-53.)

It would also be obvious to a PHOSITA to use the spectral monitor of the Smith ROADM within the Bouevitch OADM, which otherwise disclosed an external monitor and feedback. (Ex. 1028 at ¶ 90.) As the patentee stated in the '368 patent, a "skilled artisan will know how to implement a suitable spectral monitor along with an appropriate processing unit to provide a servo-control assembly in a WSP-S apparatus according to the present invention, for a given application." (*Id.* 12:11-15.) PHOSITA would also understand that the feedback

from the monitor would need to be processed to turn the power measurement into control signals for the mirrors. (Ex. 1028 at ¶ 90.) For example, the processor would need to determine the amount of tilt change required on the mirrors to adjust the power output. (*Id.*) The PHOSITA had ample motivation to combine the Smith feedback loop within Bouevitch because PHOSITA would appreciate that the feedback-driven control of Smith would improve the precision of the mirror-based switching system of Bouevitch. (*Id.*, ¶ 90.) As a contemporary document in the optical switching field stated "the actuation method for [micromirrors] is often imprecise. To achieve a variable switch, it is typically necessary to use a very high level of optical feedback." (Ex. 1009 at 2:4-9; *see also* Ex. 1028 at ¶ 90.)

4. Claim 4

Claim 4 recites "The optical add-drop apparatus of claim 3, wherein said servo-control assembly maintains said power levels at predetermined values." Specifically, Smith teaches "adjust[ing] the mirror positions to adjust the transmitted power to conform to one or more ***predetermined criteria***." (*Id.*, 11:48-51; *see also* Ex. 1005 at 4, 11, Fig. 10.) Smith discloses several such predetermined criteria, including a fixed (and thus predetermined) power level for all channels, as well as a predetermined ("standard") set of levels for each channel. First, Smith discusses setting all channels to the same power level so that downstream components can depend on equal intensity channels. (*Id.* at 9:59-

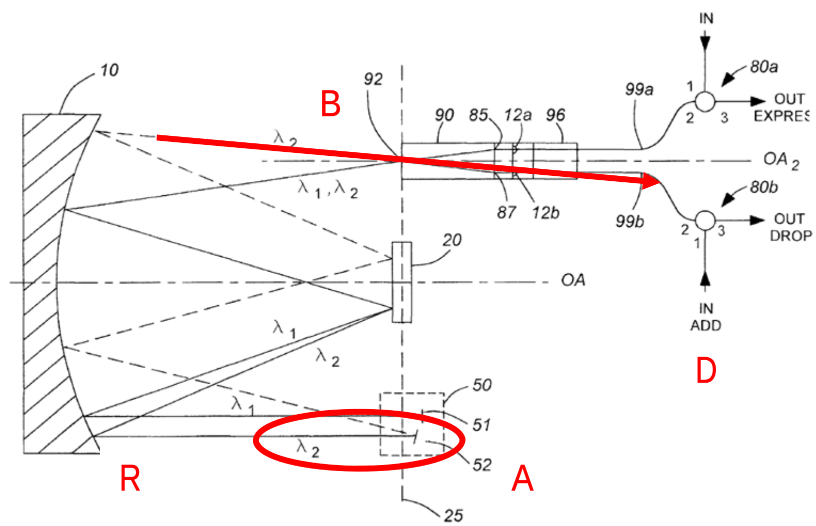
10:13.) Second, Smith discusses setting the power of each individual channel power to a "standard" power spectrum to compensate for non-flat wavelength response of downstream components. (*Id.*) This standard spectrum would require predetermined levels for each such channel. (*Id.*; Ex. 1028 at ¶ 91.)

It would have been obvious to try the predetermined power settings of Smith within Bouevitch, because there are only a limited set of types of power settings to use: predetermined and not-predetermined. (Ex. 1028 at ¶ 92.) And PHOSITA would have expected a likelihood of success using predetermined values based at least in part on Smith. Smith teaches that predetermined power values could make up for inherent problems in optical switching, such as power variations from optical amplifiers and manufacturing and environmental variations, and because "WDM systems must maintain a significant degree of uniformity of power levels across the WDM spectrum." (*Id.*, 6:24-50; Ex. 1028 at ¶ 92.)

5. Claim 5

Claim 5 recites "The optical add-drop apparatus of claim 2, wherein the control unit controls said beam-deflecting elements to direct selected ones of said first spectral channels to one or more of said second ports to be dropped as second spectral channels from said output multi-wavelength optical signal." Bouevitch is an add-drop multiplexer, and as such, discloses the ability to direct channels to a drop port. (*See* § VIII.E.1(3), above.)

Petitioner has included Figure 11-Annotation 3 from Bouevitch below. In this figure, beam-deflecting mirror 52 (annotation "A") directs the channel associated with λ_2 along a different path ("B") than the λ_1 channel and finally out of "OUT DROP" port 3 of 80b ("C"). Accordingly, the Figure illustrates the exact path that a spectral channel, once separated from the other channels, would follow to be dropped. (*Id.*, Fig 11, 14:60-65; Ex. 1028 at ¶ 94.)



Ex. 1003 at Fig. 11, (Annotation 3)

As explained for claim 2, above, it would be obvious to use the "control unit" of Smith to control MEMS mirror 52 to perform this selective beam dropping. (§ VIII.E.2; Ex. 1004 at Fig. 5, 8:47-59, 12:4-12, 10:37-44; *see also* Ex. 1005 at 11, 7, 8, Fig. 4; Ex. 1028 at ¶ 95.) To achieve switching accuracy necessary to support an optical communications application, a control unit would be necessary to position the individual mirrors 51 and 52. (*See* § VIII.E.2, above.)

6. Claim 6

Claim 6 recites "The optical add-drop apparatus of claim 2, wherein the control unit controls said beam-deflecting elements to direct selected ones of said second spectral channels to said output port to be added to said output multi-wavelength optical signal." This claim is similar to claim 5 except that it relates to adding a channel rather than dropping a channel.

Bouevitch discloses a configurable optical add drop module. (§ VIII.E.1(1), above.) It is designed to both drop and add channels to a multi-wavelength signal. (§ VIII.E.1(3), above; Ex. 1028 at ¶¶ 96-97.) Bouevitch illustrates the IN ADD port in Figure 11—shown as annotation D in Figure 11-Annotation 3 above—and explains in the corresponding specification portions that channel λ_2 enters at the IN ADD port and is combined with channel $\lambda_{1.}$ The combined channels exit together. (*Id.*, 14:66-15:18.)

Bouevitch would have performed this addition with a control unit. (Ex. 1028 at ¶ 96-97.) But to the degree that the control unit in Bouevitch was not inherent, it would be obvious to use Smith's control unit to perform this channel addition. (*See id*. ;§VIII.E.2.) Smith describes using its control unit to perform both add and drop operations. (*Id.*, Fig. 5, 8:47-59, 12:4-12, 10:37-44; *see also* Ex. 1005 at 7 ("Under the control of an external control signal, the ADM may allow a wavelength channel to pass through the switch from input to output or, alternatively, to route the input signal to the drop port and simultaneously connect the add port to the

output.")).) As explained for claim 2, above, it would be obvious to use the "control unit" of Smith to control MEMS mirror 52 to perform this selective beam addition in order to achieve the necessary switching accuracy. (VIII.E.2; Ex. 1004 at Fig. 5, 8:47-59, 12:4-12, 10:37-44; *see also* Ex. 1005 at 11, 7, 8, Fig. 4.)

7. Claim 9

Claim 9 recites "The optical add-drop apparatus of claim 1, wherein said wavelength selective device further combines selected ones of said spectral channels reflected from said beam-deflecting elements to form said output multi-wavelength optical signal." Bouevitch discloses this combination of channels when a channel is added and then combined with an existing channel. For example, Bouevitch explains, "[a]t the diffraction grating, the added optical signal corresponding to λ_2 is combined with the express signal corresponding to λ_1. The multiplexed signal is returned to the lens 90, passes through port 85, and returns to port 2 of the first circulator 80a where it is circulated out of the device from port 3." (*Id.* 15:13–18.; Figure 11; Ex. 1028 at ¶ 98.)

8. Claim 10

Claim 10 recites "The optical add-drop apparatus of claim 1, wherein said one or more other ports comprise an add port and a drop port for respectively adding second and dropping first spectral channels." Bouevitch discloses these ports at the "IN ADD" port and the "OUT DROP" port. (*Id.*, Fig. 11; 14:62–15:1;

Ex. 1028 at ¶ 99.) For convenience, Petitioner labeled the ports in Fig. 11-Annotation 3, above. IN ADD port is labeled as "D" and the "OUT DROP" port is labeled as C. Petitioner previously discussed these two ports when addressing claims 5 and 6. (*See* §§ VIII.E.5, VIII.E.6.)

9. Claim 11

Claim 11 recites "The optical add-drop apparatus of claim 1 further comprising a beam-focuser for focusing said separated spectral channels onto said beam deflecting elements." As discussed in the BRI section VII.H, above, the BRI for the term "beam focuser" is "a device that directs a beam of light to a spot."

Bouevitch discloses this beam-focuser element at reflector 10 in Figure 11. Referring to Figure 11-Annotation 3 above, reflector 10 directs the separated beams of light λ_1 and λ_2 from the points on the reflector annotated as R onto the corresponding beam deflecting mirrors 51 and 52 in MEMS array 50. (Ex. 1028 ¶ 101; Bouetvitch, Figs. 11, 6a, 15:7-11, 14:14-20, 48-55; Ex. 2018, Fig. 1, 8:46–49 (A beam of light "is reflected from the diffraction grating 120, and is transmitted through lens 110b, where it is collimated and incident on the modifying means 150."); *see also* Ex. 1004 at 12:43-50 ("A lens system 202 focuses the beams onto a MEMS mirror array"), Ex. 1005 at 7-8.) Bouevitch's description of other examples of reflector 10 (examples that Bouevitch describes as compatible with the Fig. 11) confirms that the reflector focuses channels onto the MEMS mirrors.

Specifically, "The plurality of ***sub-beams of light*** are transmitted to the spherical reflector **610** where they are collimated and transmitted to the modifying means **150** where they ***are incident thereon as spatially separated spots*** corresponding to individual spectral channels." (*Id.*, 10:41-47; emphasis added; Ex. 1028 at ¶ 101.) The "modifying means 150" includes the MEMs array 50 of Fig. 11. (*Id.*)

10. Claim 12 – Grounds 1, 2, 3 and 4

Claim 12 recites "The optical add-drop apparatus of claim 1, wherein said wavelength-selective device comprises a device selected from the group consisting of ruled diffraction gratings, holographic diffraction gratings, echelle gratings, curved diffraction gratings, and dispersing prisms." Petitioner discusses below four separate grounds under which claim 12 is obvious.

Under Ground 1 (Bouevitch+Smith), Bouevitch discloses the claimed wavelength-selective element in the form of a prism. As discussed further below, the use of a prism as recited in claim 12 was obvious.

Under Ground 2, Petitioner adds Lin to Bouevitch+Smith, should the Board decide that Ground 1 does not disclose "continuously." (*See* ¶ VIII.E.1(6), above) Because ground 2 includes Bouevitch, Claim 12 is obvious under Ground 2 for the same reasons as Ground 1.

Ground 3 is only necessary should the Board find that neither Grounds 1 nor 2 describe the "wavelength-selective device" of Claim 12. Under Ground 3

(Bouevitch+Smith+Dueck, also discussed below), Petitioner adds the Dueck reference to Ground 1 to further disclose "ruled diffraction gratings" and support the obviousness of using these gratings in the system of claim 12.

Under Ground 4, Petitioner adds Dueck to Ground 2. Claim 12 is obvious under Ground 4 (Bouevitch+Smith+Lin+Dueck) for the same reasons as Ground 3.

Returning now to Grounds 1 and 2, it would have been obvious under either ground to use any of the types of wavelength-selective devices recited in claim 12. Each type was known in the prior art, each was interchangeable as a wavelength-selective device, and each was one of a small set of possible choices. (Ex. 1028 at ¶¶ 103-104.) For example, Bouevitch discloses the use of prisms as wavelength-selective devices through Bouevitch's incorporation by reference of U.S. Patent No. 5,414,540 ("Patel"). Patel notes that prisms are one type "frequency-dispersive mediums" that include diffraction gratings. (*Id.*, 3:20-36 (incorporated in Ex. 1003 at 1:37-39).)

Under Ground 3, it was obvious to combine Bouevitch+Smith with other teachings of specific types of wavelength-selective devices for WDM, including Dueck. Dueck discusses "ruled diffraction gratings." (*Id.*, 6:26-30; Ex. 1028 at ¶¶ 103-104; *see also* Ex. 1027 at 6:33-36 (discussing "grating prisms").) It would be obvious to try Dueck's ruled diffraction gratings in the devices of Bouevitch and Smith. (*Id.*) The PHOSITA would be motivated to do so because Dueck describes

its grating as part of the "best mode" of separating wavelengths in WDM devices, which include the Bouevitch and Smith devices. (*Id.;* Ex. 1028 at ¶¶ 103-104.)

Similarly, under Ground 4, it was obvious to combine Bouevitch+Smith+Lin with Dueck for the same reasons given for Ground 3. (*Id*.)

11. Claim 13

Claim 13 recites "The optical add-drop apparatus of claim 1, wherein said beam-deflecting elements comprise micromachined mirrors." The MEMS (micro electromechanical systems) 1-axis and 2-axis mirrors discussed in Bouevitch and Smith are beam-deflecting "micromachined mirrors." (Ex. 1028 at ¶ 105.) MEMS are often described in the prior art as "micromachined mirrors." (*See, e.g.*, Goldstein, 3:48-50 ("In free-space MEMS crossconnects, micromachined mirrors are utilized as the switching elements."); *see also* § VIII.E.1(5) (discussing element 1[d], above); Ex. 1028 at ¶ 105.)

12. Claim 15 – Grounds 1 and 2

Claim 15 is an independent claim that very closely resembles claim 1. The preamble and first two elements of claim 15 are identical to the preamble and elements [a]-[b] of claim 1. These elements are disclosed by Bouevitch for the same reasons set forth in claim 1. (§ VIII.E.1) To avoid unnecessary repetition, those arguments are not copied here. They are incorporated by reference. As in claim 1, Petitioner again points to Smith+Bouevitch under Ground 1. To the extent

the Board disagrees that the "continuously" element is not present under Ground 1, Petitioner also analyzes claim 15 under Ground 2 of Smith+Bouevitch+Lin by incorporating that analysis from claim 1 here.

The remaining elements of claim 15 are discussed below. The only substantive difference between the rest of claim 15 and the other elements of claim 1 is that claim 15 replaces the "other ports" of claim 1 with "drop ports" for dropped channels. But this change does not impact validity. The differences are expressly disclosed in the applied references.

(1) Element 15[c] – drop ports for dropped channels

Claim 15 recites "one or more drop ports for selected spectral channels dropped from said multi-wavelength optical signal." Petitioner identifies this element as element 15[c]. Bouevitch discloses the "drop port" of element 15[c] as the "OUT DROP" port in element 80b port 3. Petitioner labels this port as "D" in Fig. 11-Annotation 1 in § VIII.E.1(2), above. This drop port is used for dropped channels. A spectral channel with wavelength λ_2 is dropped from the combined λ_1 and λ_2 multi-wavelength input signal and sent out the OUT DROP port. (*Id.*, 14:27-65; § VIII.E.1(3) (discussing element 1[b], above); Ex. 1028 at ¶ 108.)

(2) Element 15[d]-[e]

The next element of claim 15— referred to as 15[d], recites "a wavelength-selective device for spatially separating said multiple spectral channels." This is

identical to claim 1[c], and is disclosed by Bouevitch for the same reasons discussed for 1[c]. (§ VIII.E.1(4).)

The next element of claim 15—15[e]—recites “a spatial array of beam-deflecting elements…” This element is identical to claim 1[d] and is disclosed by Bouevitch+Smith for the same reasons discussed for 1[d], above. (§ VIII.E.1(5).)

(3) Element 15[f] – dropped channels to drop ports

Finally, the last element of claim 15, identified here as 15[f], recites “whereby a subset of said spectral channels is directed to said drop ports.” As discussed in the BRI section, this element should not be limiting. But even if it is limiting, Bouevitch discloses dropping subset channel λ_2 from the combined set of channels λ_1 and λ_2 and directing λ_2 out the OUT DROP port. (Ex. 1003 at 14:27-65; § VIII.E.12(1) & VIII.E.1(3) (15[c] and 1[b], above) ; Ex. 1028 at ¶111.)

13. Claim 16 – Grounds 1 and 2

Claim 16 is another independent claim. The only difference between claim 16 and claim 15, above, is that claim 16 focuses on add ports instead of drop ports. Claim 16 recites one or more ***add*** ports for ***adding*** channels to the multi-wavelength output channel instead of one or more ***drop*** ports for ***dropping*** channels. Specifically, claims 15 and 16 are identical but for claim 16’s recitation of element 16[c]: “one or more add ports for selected spectral channels to be added to said output multi-wavelength optical signal,” and 16[e]: “whereby said spectral

channels from said add ports are selectively provided to said output port."

Thus, Bouevitch+Smith under Ground 1 or Bouevitch+Smith+Lin disclose all elements of claim 16 (other than [c] & [e]) for the same reasons as discussed for claim 15, above. (*See* §VIII.E.12.) This same combination also teaches elements 16[c] & [e], as discussed below.

(1) Element 16[c] – Add ports for added channels

Element 16[c] recites "one or more add ports for selected spectral channels to be added to said output multi-wavelength optical signal." Bouevitch discloses an "add" port in Figure 11. Figure 11 shows the port as 80b port 1, labelled "IN ADD" (annotated as "C" in *Id.*, Fig. 11-Annotation 1, § VIII.E.1(2), above). (*See* §§ VIII.E.1(3), VIII.E.6 (discussing element 1[b] and claim 6, above); Ex. 1028 at ¶ 114.) Bouevitch explains that the purpose of the add port is for allowing a selected subset of channels to be added to a multi-wavelength signal. Specifically, Bouevitch adds spectral channel λ_2 at the IN ADD port. (*Id.*, 14:27-65.) Channel λ_2 is then added into the output multi-wavelength optical signal. (*Id.*, 14:66-15:18 (channel λ_2 entering at annotation "D" in Fig. 11-Annotation 1 is added to another channel (λ_1), which together exit output port "C").)

(2) Element 16[e] – Addition of channels from add ports

With respect to element 16[e] ("whereby said spectral channels from said

add ports are selectively provided to said output port"), Bouevitch teaches that added channel λ_2 from the IN ADD port is selectively added to the final output channel that exits the "OUT EXPRESS" port (annotated as "E," in Fig. 11-Annotation 1, above). Depending on the orientation of MEMS mirror 52 in Fig. 11, the added channel λ_2 is either directed to the OUT EXPRESS port, or is reflected back along the same optical path to the ADD port from where it originated, thus dropping the channel. (*See id.*, 14:38-15:18; Ex. 1028 at ¶ 115.)

14. Claim 17 – Grounds 1 and 2

Claim 17 is a method claim version of claim 1 with very minor additions. The preamble of claim 17 recites "A method of performing dynamic add and drop in a WDM optical network." Bouevitch describes a method for operating a "Configurable Optical Add/Drop Multiplexer (COADM)." (*See* § VIII.E.1(1), above; Ex. 1003 at Abstract; *see also Id.*, 3:9-63, 5:15–20; 14:14-21; Figs. 1, 11.) The "dynamic" portion of this preamble is discussed below for element 17[c]. Bouevitch also describes WDM (wavelength division multiplexing) as the background of the Bouevitch invention, in which the COADM operates to add/drop different wavelengths that are multiplexed together in the input port. (*See* Ex. 1003 at 1:18-30, 14:14-15:18; § V.) As for claims 1, 15 and 16, claim 17 is obvious under both Grounds 1 and 2, and Petitioner incorporates by reference its arguments for those claims here to avoid replication.

(1) Element 17[a] – Separating signal into channels

What is identified here as claim 17[a] recites "separating an input multi-wavelength optical signal into spectral channels." Bouevitch discloses this step at Figure 11, where diffraction grating 20 spatially separates combined channels $\lambda_1\lambda_2$ ("A" at Fig. 11-Annotation 2, above) into spatially-separated channels. (*See, e.g.*, § VIII.E.1(4) (element 1[c]), above, Bouevitch, annotation "B"; Ex. 1003 at 14:48-53, 8:10–22; Ex. 1028 at ¶ 117.)

(2) Element 17[b] – Imaging channels

What is identified here as claim 17[b] recites "imaging each of said spectral channels onto a corresponding beam-deflecting element." Claim 21 confirms that one type of such "imaging" is focusing, by reciting "the method of claim 17, wherein said ***imaging comprises focusing*** said spectral channels onto said beam–deflecting elements" (emphasis added). By using the word "comprising" in claim 21, it indicates that imaging is apparently broader than focusing, and thus that imaging at least encompasses focusing. Therefore, art that teaches focusing necessarily discloses the "imaging" of element 17[b], because a species anticipates a claim to a genus. (MPEP §§ 2131.02.)

Bouevitch discloses this imaging step by using reflector 10 in Figure 11-Annotation 3, above, to image (focus) each channel onto a corresponding MEMS mirror element. (*See* § VIII.E.9 (claim 11), Ex. 1003 at Figs. 11, 6a, 15:7-11,

14:14-20, 48-55, Fig. 1, 8:46–49; Ex. 1004 at 12:43-50 (“lens system 202 focuses the beams onto a MEMS mirror array 204, placing the gaussian waists of the beams at the mirror surfaces.”), Ex. 1005 at 7-8; Ex. 1028 at ¶ 119.)

(3) Element 17[c] – Dynamic & continuous 2-axis control

What is identified here as claim 17[c] recites: “controlling dynamically and continuously said beam-deflecting elements in two dimensions so as to combine selected ones of said spectral channels into an output multi-wavelength optical signal and to control the power of the spectral channels combined into said output multi-wavelength optical signal.” The only substantive difference between claim 17[c] and claim 1[d] is the addition in 17[c] of “controlling ***dynamically*** and continuously.” Thus, other than for “dynamically,” the method step of claim 17[c] is disclosed by Bouevitch+Smith for all the reasons discussed for claim 1[d], above. (*See* § VIII.E.1(5).)

As for “dynamically” controlling the beam-deflecting mirrors, both Bouevitch and Smith contemplate this manner of control. The plain and ordinary meaning of “dynamically” in the context of the ‘368 patent is “during operation.” (*See* Ex. 1003 at 3:22-23 (contrasting routing that is fixed during operation: "the [prior art] wavelength routing is intrinsically static, rendering it difficult to dynamically reconfigure these OADMs."); Ex. 1028 at ¶ 121.)

Both Bouevitch and Smith teach dynamic control during the operation of their add/drop devices. (Ex. 1028 at ¶ 122.) Bouevitch's device can be used as a "dynamic gain equalizer and/or configurable add/drop multiplexer," which plainly includes dynamic control of the mirrors that perform those actions. (*Id.*, 2:24-25.) Smith notes that it "is well known" that power control "should be dynamic and under feedback control since the various wavelength components ***vary in intensity with time***." (*Id.*, 6:37-50; emphasis added, 2:23-31, 7:24-31). The Smith Provisional also supports dynamic control, as is apparent from the fact that the Smith OADM accepts control signals/commands as it operates. (*See* Smith Provisional, Fig. 11 (noting "continuous" calibration and control by "network commands"), 7 (add/drop under control of an external (and thus changeable) signal); Ex. 1028 at ¶ 122.)

15. Claim 18

Claim 18 recites "The method of claim 17, wherein said selected ones of said spectral channels comprises a subset of said spectral channels, such that other non-selected ones of said spectral channels are dropped from said output multi-wavelength optical signal." Claim 18 is substantively identical to a portion of apparatus claim 15, whereby "a subset of said spectral channels is directed to said drop ports," and is disclosed by Bouevitch+Smith for the same reasons discussed for claim 15. (*See* § VIII.E.12.) Unsurprisingly, because both Bouevitch and

Smith describe optical add/drop multiplexers, both also describe dropping one subset of channels, adding others, and passing the resulting combination on through an output port. For example, Bouevitch describes selecting a subset of combined channels $\lambda_1\lambda_2$ (i.e., the subset λ_1) to pass through to the output, while the non-selected channel, λ_2, is dropped. (*See* §§ VIII.E.5, VIII.E.6; Ex. 1028 at ¶114.)

16. Claim 19

Claim 19 recites "The method of claim 18, wherein said controlling comprises reflecting said non-selected ones of said spectral channels to one or more drop ports." Claim 19 is also substantively identical to a portion of apparatus claim 15, where the beam-deflecting elements reflect a subset of their corresponding channels to one or more drop ports. Thus, claim 19 is disclosed by Bouevitch+Smith for the same reasons as for claim 15. For example, if input channel is not selected for retention, it is reflected along a path where it exits the "OUT DROP" port in Bouevitch. (*See id.*, 14:60-65, § VIII.E.12, above.)

17. Claim 20

Claim 20 recites "The method of claim 17 further comprising imaging other spectral channels onto other corresponding beam-deflecting elements, and controlling dynamically and continuously said other beam-deflecting elements so as to combine said other spectral channels with said selected ones of said spectral channels into said output multi-wavelength optical signal." The only limitations

this dependent claim adds to the operations recited in parent claim 17 is imaging (focusing) "other channels" to "other beam-deflecting elements" to combine the resulting channels into one output signal.

In addition to the two channels and respective mirrors addressed for claim 17 (§VIII.E.14, above), both Bouevitch and Smith disclose arbitrarily-sized ROADMS and explicitly discuss embodiments that process additional channels by selectively reflecting them to respective deflecting elements. (*E.g.*, Ex. 1028 at ¶ 126; Ex. 1003 at 8:8-43 (discussing dropping λ_3, while passing through "the other 7 channels having central wavelengths λ_1-λ_2 and λ_4-λ_8."; Ex. 1004 at 12:4-11 ("An NxN cross connect can be implemented by increasing the numbers of fibers"), 2:64-67; Ex. 1005 at 2 ("At the present time, commercially-available systems can support 40, 2.5GHz channels").)

It was also obvious to perform the add/drop steps of Bouevitch+Smith on additional spectral channels, as more channels provides additional (and desirable) capacity in a WDM system, and multi-channel systems were known. (Ex. 1001 at 1:31-42; Ex. 1028 at ¶ 127.)

18. Claim 21

Claim 21 recites "The method of claim 17, wherein said imaging comprises focusing said spectral channels onto said beam–deflecting elements." Claim 17[b] already recites "imaging each of said spectral channels onto a corresponding beam-

deflecting element." And Bouevitch discloses the recited "imaging" by using reflector 10 in Figure 11-Annotation 3, above, to image (focus) each channel onto a corresponding MEMS mirror element. (*See* § VIII.E.14(2), Ex. 1028 at ¶ 128.)

19. Claim 22

Claim 22 recites "The method of claim 17 further comprising monitoring a power level in one or more of said selected ones of said spectral channels, and controlling an alignment between said input multi-wavelength optical signal and corresponding beam-deflecting elements in response to said monitoring." Claim 22 is similar to claim 3, and is obvious for the same reasons. (*See* § VIII.E.3.) Under either Grounds 1 or 2, Smith explicitly describes the use of a feedback loop to control alignment of the angle of the beam-deflecting elements with respect to the angle of the input signals incident on those elements. (*See, e.g.* Smith, 16:9-11, 34-51; § VIII.E.1(5), "2-Axis Mirrors & Power Control" section, above.) This angle affects alignment of those same signals and the output ports, which then determines the power level of the output ports, and which are in turn monitored to provide a feedback signal to further control the alignment of the beam-deflecting elements. Specifically, Smith's controller "receives the outputs of the optical power monitor 218, or more specifically the detected optical intensities of the detector array, and accordingly readjusts the tilt positions of the micromirrors in the MEMS array." (*See* Ex. 1004 at 18:11-21 ("Moving a beam off maximum

alignment with its waveguide in the direction of a closely neighboring waveguide may increase the cross talk"), Ex. 1005 at 6, Fig. 4; Ex. 1028 at ¶ 129.)

IX. WRITTEN DESCRIPTION SUPPORT FOR THE SMITH PATENT'S SEPTEMBER 22, 2000, PRIORITY DATE

The Smith Patent is § 102(e) prior art as of the September 22, 2000, filing date of its corresponding provisional application, No. 60/234,683. (*See* § VIII.A, above.) As shown by Petitioner's parallel citations above to both the Smith Patent and Provisional, the Smith Provisional patent provides written description support for each aspect of the Smith Patent which Petitioner relies upon. (Ex. 1028 at 130.) To further confirm the Smith Patent's priority date, Dr. Marom analyzed each claimed feature of the claimed invention of the '368 patent and concluded that both the Smith Patent and the Smith Provisional disclose each such feature. (Ex. 1028 at ¶¶ 130-132.) As part of this analysis, Dr. Marom provides an element-by-element comparison of the Smith Provisional and the Smith Patent in chart form in his declaration. (Ex. 1028 at ¶ 132.)

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned certifies that on July 15, 2014, a complete and entire electronic copy of this **Petition for Inter Partes Review No. 2014-01166**, including Exhibit Nos. 1001-1038 and a Power of Attorney, was served via USPS EXPRESS MAIL, costs prepaid, to the Patent Owner by serving the correspondence address of record as follows:

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